Transactions of the Royal Society of S. Aust. (2001), **125**(2), 133-139.

SPECIES OF *RAILLIETINA* FUHRMANN, 1920 (CESTODA: DAVAINEIDAE) FROM THE SOUTHERN CASSOWARY (*CASUARIUS CASUARIUS*)

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Summary

O'CALLAGHAN, M. G., ANDREWS, R. H., DAVIES, M. & SPRATT, D. M. (2001) Species of *Raillietina* Fuhrmann, 1920 (Cestoda: Davaineidae) from the southern cassowary (*Casuarius casuarius*). *Trans. R. Soc. S. Aust.* **125** (2), 133-139, 30 November, 2001.

A new species of *Raillietina* is described from the intestine of the southern cassowary, *Casuarius casuarius*, from Australia. It is a small cestode and differs from cestodes previously described from cassowaries in the size of the scolex, rostellum, rostellar hooks, suckers and cirrus sac. *Raillietina casuarii* is redescribed from specimens collected in Australia. *Raillietina casuarii* and *R. infrequens* were identified in a southern cassowary from New Guinea.

KEY WORDS: Cestoda, cassowary, *Raillietina*, new species, *Casuarius casuarius*.

Introduction

Two species of *Raillietina* have been reported from Casuariidae by Kotlan (1923) who described *Raillietina casuarii* and *R. infrequens* from a large collection of parasites belonging to the Hungarian naturalist, Lewis Biró, accumulated during the years 1897-1899 from *Casuarius bennetti picticollis* Sclater, 1874 in New Guinea. More recently, Schmidt (1975) identified the same cestode species from *C. bennetti* Gould, 1858 at another location in New Guinea. The related southern cassowary, *C. casuarius* (Linnaeus, 1758), inhabits north-eastern Australia and New Guinea (Pollock 1992). In 1917, Macgillivray recorded the presence of unidentified tapeworms in the intestine of *C. casuarius johnsonii* Mueller, 1866 "hagged" on the upper Claudie River during an ornithologists' excursion to Cape York Peninsula, Queensland. In this study, we have examined the cestodes collected from nine *C. casuarius*; one from New Guinea, seven from known localities in Australia and one with no collection data. Three cestode species have been identified and all are assigned to the genus *Raillietina* Fuhrmann, 1920 (*sensu* Jones & Bray 1994) on the basis of the possession of two rows of numerous, hammer-shaped rostellar hooks, unilateral genital pores, a small cirrus sac which does not cross or just crosses the osmoregulatory canals and egg capsules containing several eggs. Here we describe a new species of *Raillietina* and report the presence of *R. casuarii* and *R. infrequens* for the first time in *C. casuarius*.

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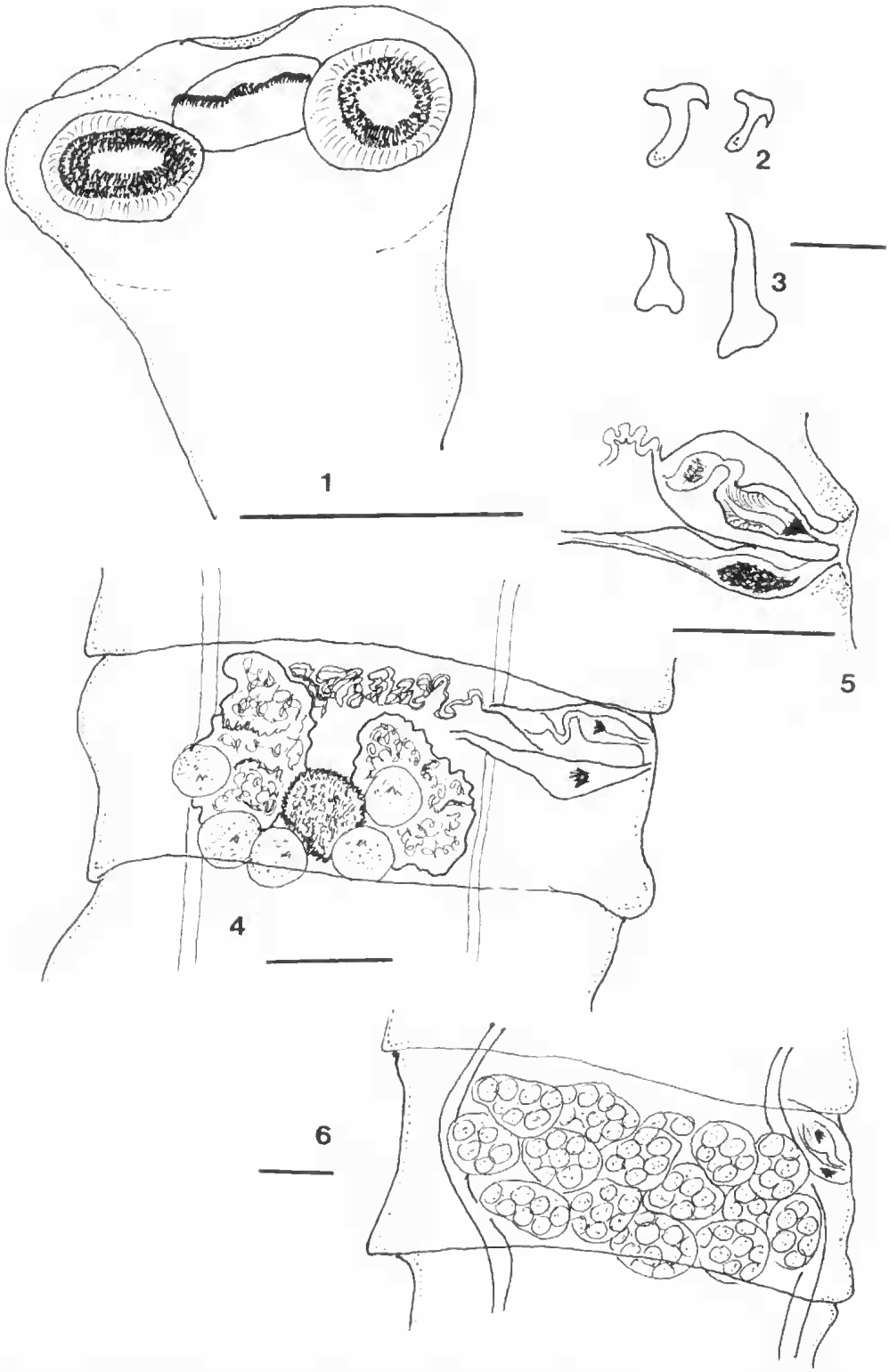
Materials and Methods

Southern cassowaries, *C. casuarius*, were collected as road kills by staff of the Queensland National Parks and Wildlife Service and frozen. At a later date, the birds were transported to CSIRO Sustainable Ecosystems (formerly Division of Wildlife and Ecology) in Canberra where the cestodes were recovered from intestines and preserved in 10% formalin. Some of the material examined consisted of cestode fragments only. Proglottides were stained in Celestine Blue and Heidenhain's haematoxylin, dehydrated in ethanol, cleared in clove oil and mounted in Canada Balsam. Scoleces were mounted and cleared in De Fauré's medium. Measurements of the cestodes examined are given in the text, in mm, as a range followed, in parentheses, by the mean and number of observations. Illustrations were made with the aid of a camera lucida attached to an Olympus BH microscope. Type specimens have been deposited in the Australian Helminth Collection (AHC) of the South Australian Museum, Adelaide (SAMA) and in the CSIRO Wildlife Helminthological Collection, Sustainable Ecosystems, Canberra (W/L HC).

Raillietina geraldschmidti sp. nov. (FIGS 1-6)

Holotype: Scolex on slide, 2 specimens on slides, 3 specimens, Mission Beach, Qld (17° 52′ S, 146° 06′ E), coll. D. M. Spratt, 3.ix.1999, SAMA AHC 28397, 31475.



Figs 1-6. *Raillietina geraldschmidti* sp. nov. 1. Scolex. 2. Rostellar hooks. 3. Sucker hooks. 4. Mature proglottis. 5. Cirrus and distal vagina. 6. Gravid proglottis. Scale bars = 0.1 mm 1, 4-6; 0.01 mm 2, 3.

Paratypes: 1 slide, 2 specimens, Mission Beach, Qld (17° 52′ S, 146° 06′ E), coll. D. M. Spratt, 3.ix.1999, SAMA AHC 28398, 31476; 1 specimen, El Arish, Qld (17° 49′ S, 146° 00′ E), coll. D. M. Spratt, 28.xi.1999, SAMA AHC 31477; cestode fragments, Edy Bay, Qld (17° 34′ S, 146° 05′ E), coll. D. M. Spratt, 4.i.1998, SAMA AHC 31478; mature proglottides on slide, Mission beach, coll. F. Crome & D. M. Spratt, 7.vi.1987, SAMA AHC 28399.

Other material: W/L HC C941, W/L HC C939

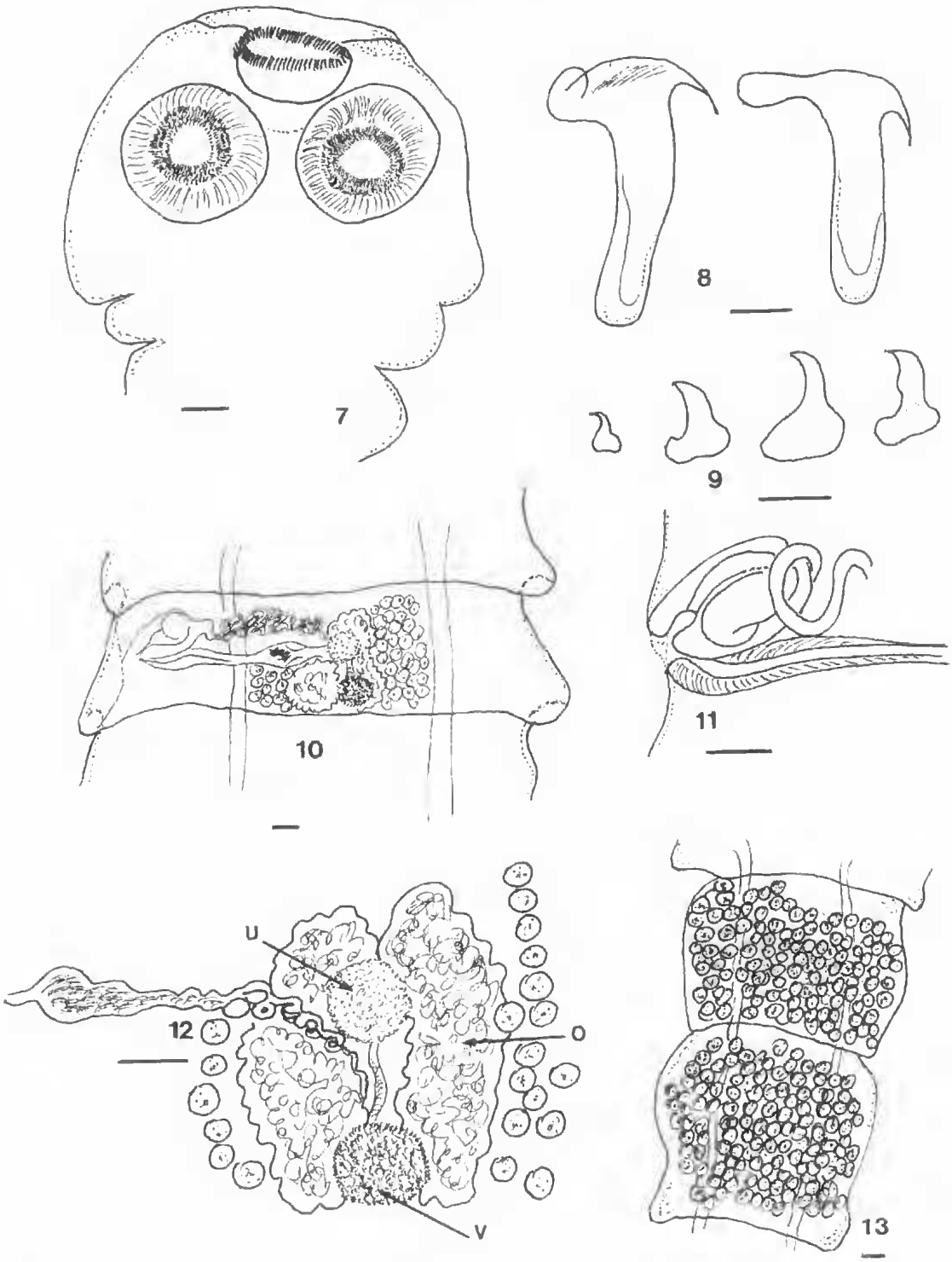
Description

Description based on mounted specimens of three strobilae, cestode fragments consisting of mature proglottides and two scoleces. Small cestode, maximum length 40 in relaxed specimens, maximum width 0.760. Strobilae contain approximately 450 proglottides. Scolex 0.155-0.180 (0.166, n=3) in diameter with retracted rostellum 0.064-0.074 (0.069, n=2) in diameter (Fig. 1). Rostellum armed with 218-238 (228, n=2) hammer-shaped hooks in two circular rows. Larger, anterior rostellar hooks 0.008-0.009 (0.008, n=20) in length; smaller, posterior rostellar hooks 0.007-0.008 (0.007, n=20) in length (Fig. 2). Rostellum armed with minute accessory spines 0.001 in length visible under high magnification only. Suckers 0.052-0.072 (0.059, n=8) in diameter armed with hooks 0.005-0.014 in length (Fig. 3). Proglottides acraspedote. Immature proglottides longer than wide, 0.112-0.152 (0.130) x 0.036-0.072 (0.060, n=10). Mature proglottides wider than long 0.080-0.144 (0.104) x 0.312-0.560 (0.426, n=10) (Fig. 4). Genital pores single, unilateral. Lateral dorsal osmoregulatory canals 0.028-0.036 in diameter joined by transverse commissures, 0.008 in diameter, in posterior region of proglottides. Ventral osmoregulatory canal not seen. Cirrus sac 0.108-0.124 (0.116) x 0.048-0.052 (0.049, n=10) (Fig. 5) extending anteromedially to but not crossing lateral osmoregulatory canal. Distal region of cirrus narrow, mid region enlarged, lined with spines, proximal region forms spherical internal seminal vesicle 0.018-0.030 (0.023, n=10) in diameter. External seminal vesicle absent. Vas deferens narrow, greatly coiled, passing medially towards centre of proglottis. Testes 5-7 in number, lying within area bounded by lateral osmoregulatory canals, usually overlying ovary and vitellarium; testes 0.036-0.044 (0.039, n=10) in diameter in poral and aporal groups, 2 poral and 3-4, occasionally 5, aporal.

Vagina and cirrus opening into common genital atrium, vagina opening posterior to cirrus. Distal region of vagina enlarged, 0.040-0.048 (0.047) x 0.018-0.024 (0.022, n=10), with a seminal receptacle 0.014-0.020 (0.016, n=10) usually containing sperm. Mid-region narrow, leading medially posterior to vas deferens. Ovary bilobed, each lobe circular, lobes approximately equal in size, 0.052-0.120 (0.088) x 0.040-0.108 (0.080, n=20). Vitellarium median, post ovarian, circular 0.048-0.076 (0.062) x 0.040-0.072 (0.053, n=10). Gravid proglottides (Fig. 6) wider than long, 0.240-0.320 (0.251) x 0.480-0.736 (0.650, n=10). Egg capsules 0.072-0.080 (0.075) x 0.064-0.080 (0.066, n=5), spheroidal, 16-20 in each

TABLE 1. *Measurements of the principle tenures of* Raillietina *species in Casuarius casuarius.*

	R. cesarpili Kotlan (1923)	*R. casuarii* Anau, N. G.	*R. casuarii* Lt Arish, Qld	*R. infrequens* Kotlan (1923)	*R. infrequens* Anau, N. G.	*R. geraldschmidti*
Size (mm)	340 x 3	140 x 1.5	200 x 3.4	80 x 1.2	50 x 0.920	40 x 0.760
Dimensions of scolex (mm)	1.0-1.2	0.910	0.962	0.500	0.456	0.166
Size of large rostellar hooks (mm)	0.048-0.054	0.046-0.053	0.038-0.042	0.027-0.034	0.022-0.024	0.008-0.009
Size of small rostellar hooks (mm)	0.040-0.046	0.038-0.046	0.032-0.037	0.021-0.025	0.017-0.019	0.007-0.008
Number of rostellar hooks	250	176-212	172-192	260	-	218-238
Diameter of suckers (mm)	0.400	0.344	0.349	0.130	0.128	0.059
Dimensions of cirrus sac (mm)	0.230 x 0.160	0.346 x 0.192	0.256 x 0.146	0.180-0.200 x 0.060	0.174 x 0.056	0.116 x 0.049



Figs 7-13. *Raillietina custarni* from Australia. 7. Scolex. 8. Rostellar hooks. 9. Sucker hooks. 10. Mature proglottis. 11. Cirrus sac and distal vagina. 12. Female genitalia. 13. Gravid proglottis. Scale bars = 0.1 mm 7, 10-13; 0.01 mm 8, 9 Legend: o, ovary; u, developing uterus; v, vitellarium.

proglottis, containing 11-13 circular eggs 0.020-0.032 (0.026, n=10) in diameter. Oncosphere circular 0.012-0.016 (0.015, n=10) in diameter, embryonic hooks 0.006 long.

Host
Casuarius casuarius Linnaeus, 1758 (Struthioniformes: Casuariidae).

Location in host
Intestine

Etymology
Named for the late Dr G. Schmidt in recognition of his outstanding contribution to our knowledge of cestodes.

Comparison with other species

Raillietina geraldschmidti sp. nov. can be distinguished from congeners in the Casuariidae by size, the small rostellar hooks and small scolex (Table 1). Of the species of *Raillietina* described in the Struthioniformes, *R. geraldschmidti* most closely resembles *R. mitchelli* described recently by O'Callaghan, Davies & Andrews (2000). *Raillietina geraldschmidti* differs from *R. mitchelli* in the size of the scolex (0.166 v. 0.298), rostellar hooks (0.007-0.009 v. 0.008-0.012) and cirrus sac (0.116 x 0.049 v. 0.161 x 0.038). In addition, *R. geraldschmidti* is smaller than *R. mitchelli* and has fewer rostellar hooks (228 v. 316).

Raillietina casuarii (Kotlan, 1923) (FIGS 7-13)

Davainea casuarii Kotlan, 1923. Ann. Trop. Med. Parasitol. 17, 45-57. Figs 1-5.
Raillietina (Ransomia) casuarii: Fuhrmann, 1920
Kotlania casuarii: Lopez-Neyra, 1931
Kotlanotaenia casuarii: Spasskii, 1973
Raillietina casuarii: Fuhrmann, 1924

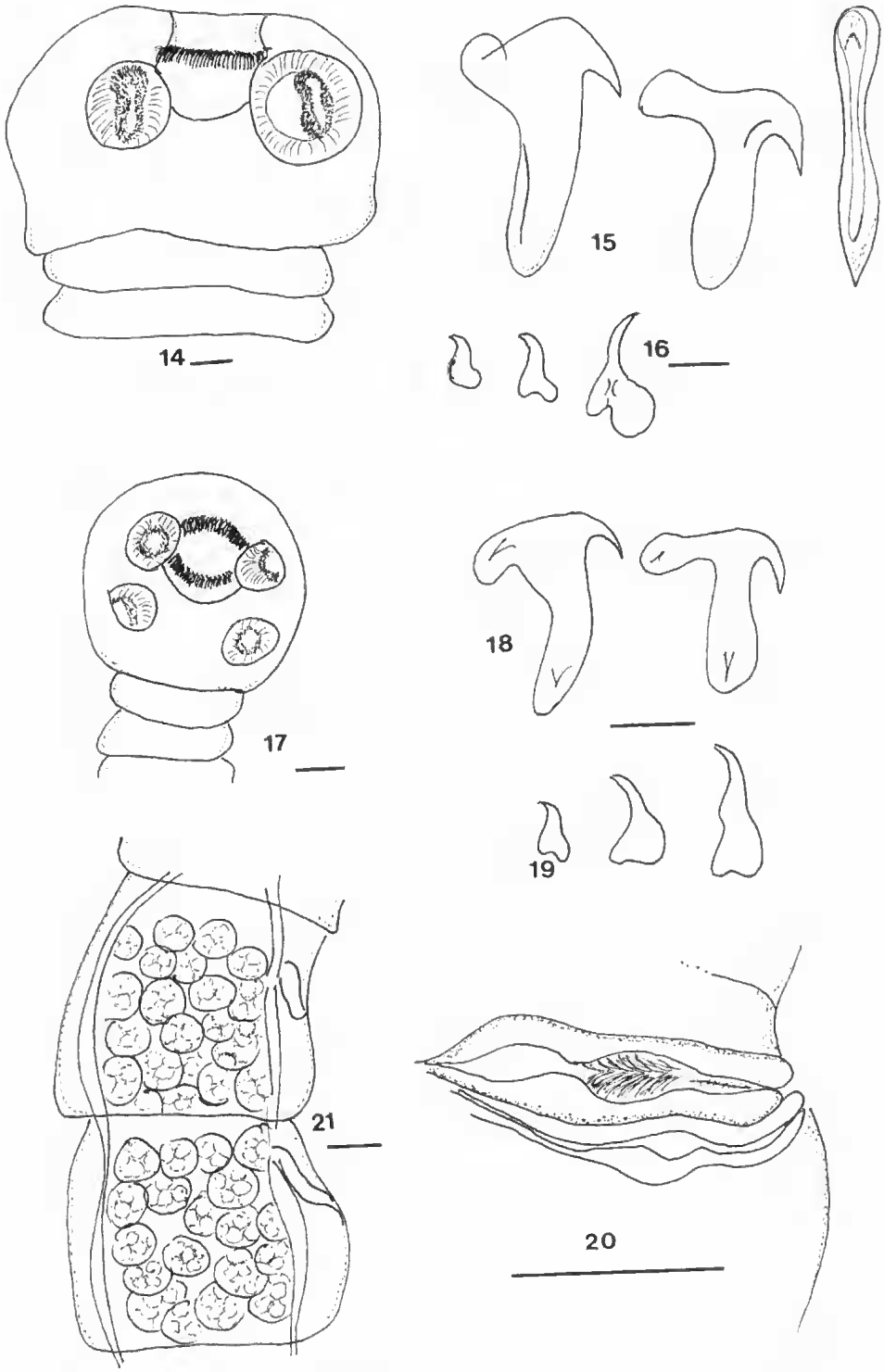
Material examined: 4 specimens, El Arish, Qld (17° 49' S, 146° 00' E), coll. D. M. Spratt, 28.xi.1999, SAMA AHC 31481; 12 specimens, Mission Beach, Qld, coll. D. M. Spratt, 3.ix.1999 SAMA AHC 31479, 31480; 1 specimen on slide, Queensland University, no collection data, SAMA AHC 28400; 2 strobilae on slides, 6 specimens, Amau, New Guinea (10° 02' S, 148° 40' E), coll. W. B. Hitchcock, 4.ix.1969 SAMA AHC 12878, 22349.

Other material: W/L HC C940, W/L HC 942

Revised description
Description based on mounted specimens of four strobilae and five cleared scoleces. Large cestode, up to 200 in unrelaxed specimens, maximum width 3.4. Strobila contains approximately 700 proglottides. Scolex 0.800-1.048 (0.962, n=5) in diameter with eversible rostellum 0.304-0.360 (0.323, n=5) in diameter (Figs 7, 14). Rostellum armed with 172-212 (190, n=9) hammer-shaped hooks in two circular rows. Larger, anterior rostellar hooks 0.038-0.053 (0.045, n= 50) in length; smaller, posterior rostellar hooks 0.032-0.046 (0.039, n=50) in length (Figs 8, 15). Rostellum armed with accessory spines 0.002-0.003 in length visible under high magnification only. Suckers, circular, 0.320-0.368 (0.347, n=9) in diameter, armed with 10-13 rows of hooks 0.005-0.021 in length (Figs 9, 16).

Proglottides craspedote. Mature proglottides wider than long 1.777-1.898 (1.836) x 0.343-0.505 (0.428, n=10) (Fig. 10). Genital pores single, unilateral. Dorsal osmoregulatory canal narrow, 0.010 in diameter, ventral osmoregulatory canal 0.040-0.064 in diameter. Narrow transverse osmoregulatory canals connect right and left dorsal and ventral canals at posterior margin of each proglottis. Large cirrus sac 0.232-0.336 (0.286) x 0.128-0.208 (0.169, n=20) extending anteriorly, not reaching lateral osmoregulatory canals. Distal region of cirrus of greater internal diameter than proximal region, armature not seen, mid-region expanding to form large internal seminal vesicle folded dorsally, 0.096-0.128 (0.102, n=10) maximum diameter (Fig. 11). Vas deferens greatly coiled passing medially towards centre of proglottis. Testes 0.048-0.056 (0.049, n=12) in diameter, number 43-51 per proglottis, always more testes on aporal field; 12-14 (13) in poral field, 31-37 (35) aporal.

Vagina opening to genital atrium posterior to male genital pore, distal region with thickened muscular wall 0.028-0.036 (0.033, n=10) wide. Mid region with thickened wall extending, uncoiled, medially and posterior to vas deferens, region internal to osmoregulatory canals dilated and filled with sperm, proximal region coiled. Ovary bilobed, poral lobe 0.200-0.240 (0.214) x 0.112-0.120 (0.115, n=5), aporal lobe 0.240-0.280 (0.269) x 0.112-0.136 (0.122, n=5) with 3-4 lobules in each lobe. Vitellarium median, post ovarian, sub-circular 0.128-0.152 (0.144) x 0.096-0.136 (0.110, n=10). Uterine duct passing anteriorly to developing uterus (Fig. 12). Gravid proglottides 1.000-2.121 (1.860) x 0.606-1.080 (0.731, n=10) (Fig. 13) filled with egg capsules. Egg capsules sub-spherical to ovoid, containing 1-4 eggs, mostly 1-2, seldom 3 or 4. Capsules containing one egg 0.052-0.072 (0.062) x 0.048-0.064 (0.056, n=10), containing two eggs 0.076-0.104 (0.091) x 0.052-0.072 (0.060, n=10). Approximately 250-300 egg capsules in each proglottis. Eggs spherical 0.040-0.052 (0.045) x



Figs 14-16. *Raillietina casuarii* from New Guinea. 14. Scolex. 15. Rostellar hooks. 16. Sucker hooks.

Figs 17-21. *Raillietina infrequens* from New Guinea. 17. Scolex. 18. Rostellar hooks. 19. Sucker hooks. 20. Cirrus and distal vagina. 21. Gravid proglottides. Scale bars = 0.1 mm 14, 17, 20, 21; 0.01 mm 15, 16, 18, 19.

0.032-0.044 (0.039, n=10) containing spherical oncosphere 0.020-0.024 (0.023) x 0.020-0.024 (0.021, n=10), embryonic hooks 0.006-0.008 long.

Host

Casuarius casuarius Linnaeus, 1758 (Struthioniformes: Casuariidae).

Location in host

Intestine.

Remarks

These specimens of *R. casuarii* are smaller than those reported previously (140 v. 340) (Table 1). However, Kotlan (1923) in describing the largest cestodes from one locality, observed more contracted and shorter cestodes than those described.

Raillietina infrequens (Kotlan, 1923)
(FIGS 17-21)

Davainea infrequens Kotlan, 1923, Ann. Trop. Med. Parasitol. 17, 45-57.
Raillietina infrequens: Fuhrmann, 1932

Material examined: 1 strobila on slide, 2 specimens, Aman, New Guinea, coll. W. B. Hitchcock, 4.ix.1969 SAMA AHC 12878, 22349.

Revised description

Description based on one entire mounted specimen, segments of mature and gravid proglottides and one scolex. Strobilae are 50 long and contain 500 segments with characters that conform to those reported by Kotlan (1923). The scolex (Fig. 17) is 0.456 in diameter with a retracted rostellum 0.200 in diameter armed with two rows of hammer-shaped hooks that have become dislodged and some appear to be missing. Larger, anterior rostellar hooks 0.022-0.024 (0.023, n=10) in length; smaller, posterior rostellar hooks 0.017-0.019 (0.018, n=10) in length (Fig. 18). Circular suckers 0.116-0.140 (0.128, n=10) in diameter are armed with hooks 0.005-0.014 in length (Fig. 19). In mature segments genital pores are unilateral, with a cirrus sac and vagina which conform with the description and dimensions reported by Kotlan (1923). Cirrus sac 0.160-0.192 (0.174) x 0.048-0.060 (0.056, n=10) (Fig. 20). Gravid segments are wider than long (Fig. 21); up to six terminal segments 0.488-0.560 (0.537) x 0.336-0.520 (0.425) containing 25-32 (28, n=6) egg capsules each with 7-10 (9, n=10) eggs. Egg capsules circular 0.080-0.100 (0.090) x 0.072-0.088 (0.078, n=10).

Host

Casuarius casuarius Linnaeus, 1758 (Struthioniformes: Casuariidae).

Location in host

Intestine.

Remarks

Gravid proglottides were unavailable in the material examined by Kotlan (1923) and consequently he was unable to complete the description of *R. infrequens*. Therefore, a description of gravid segments, although from a limited number of specimens is presented here. Kotlan (1923) also estimated the size of *R. infrequens* from two fragments that apparently belonged together. The two mounted specimens of *R. infrequens* examined here are in semi-contracted form.

Discussion

The new species of *Raillietina* described in this study appears to be restricted to the southern cassowary in Australia and does not occur in the closely related emu (O'Callaghan *et al.* 2000). Although *R. geraldschmidti* sp. nov. has not previously been reported from cassowaries in New Guinea, few birds have been examined for cestodes. Similarly, *R. infrequens* was not found in the birds examined here and may be limited to cassowaries in New Guinea. Studies of additional material will be required before the distribution of *Raillietina* species in the Casuariidae can be determined.

References

JONES, A. & BRAY, R. A. (1994) Family Davaineidae Braun, 1900 pp. 407-411 *In* Khalil, L. F., Jones, A. & Bray, R. A. (Eds) "Keys to the cestode parasites of vertebrates" (CAB International, Wallingford, UK).

KOTLAN, A. (1923) Avian cestodes from New Guinea. II. Cestodes from Casuariformes. *Ann. Trop. Med. Parasitol.* **17**, 45-57.

MACGILLIVRAY, W. (1917) Ornithologists in north Queensland. *Emu* **17**, 63-87.

O'CALLAGHAN, M. G., DAVIES, M. & ANDREWS, R. H. (2000) Species of *Raillietina* Fuhrmann, 1920 (Cestoda: Davaineidae) from the emu, *Dromaius novaehollandiae*. *Trans. R. Soc. S. Aust.* **124**, 105-116.

POLLOCK, H. J. (1992) Casuariidae p. 5 *In* Strahan, R. (Ed.) "Encyclopaedia of Australian Animals. Birds" (Angus and Robertson, NSW).

SCHMIDT, G. D. (1975) New records of helminths from New Guinea, including description of three new cestode species, one in the new genus *Walhdicestus* n.g. *Trans. Amer. Microsc. Soc.* **94**, 189-196.